

EDITORIAL ARTICLES.

I.—THE ACTION OF CHLOROFORM IN THE PRODUCTION OF ANÆSTHESIA, AS DEMONSTRATED BY THE SECOND HYDERABAD COMMISSION.¹

II.—NOTES ON THE REPORT OF THE SECOND HYDERABAD CHLOROFORM COMMISSION.²

Believing from his own experience and from the teaching of the late Prof. Syme that chloroform might be administered with perfect safety, provided the administrator watched the respiration with sufficient care, Surgeon-Major Lawrie, of Hyderabad, secured the appointment of a commission by the Nizam's government to demonstrate the truth of this doctrine by laboratory experiments as well as by clinical observation. The conclusions of this committee being questioned by many authorities, and in particular by the *Lancet*, to whom they seemed insufficient to overthrow the conclusions of many other observers whose researches went to prove that one of the dangers of chloroform was from paralysis of the heart, Dr. Lawrie applied to the Nizam for the appointment of a second commission, which should contain a member nominated by the *Lancet*. That journal thereupon named Dr. Lauder Brunton, than whom no person could be better qualified for such an investigation, and whose views were at that time at variance with those of the commission.

The experiments were of two kinds: (1) those being made without recording apparatus, with a view to ascertaining the influence exerted

¹Report of the Second Hyderabad Chloroform Commission [consisting of Surgeon-Major Edward Lawrie and Drs. G. Bombard and Rustomji D. Hakim, of Hyderabad, and Dr. T. Lauder Brunton of London].—*The Lancet*, Jan. 18, 1890.

²By Alexander Wilson, M.R.C.S., Administrator of Anæsthetics, Royal Infirmary, Manchester.—*The Medical Chronicle* (Manchester), April, 1890.

by various conditions on the relations between stoppage of the heart and of respiration and the limits within which artificial respiration and other means of resuscitation are useful. (2) Those with recording apparatus, made to ascertain the effect of various conditions upon heart and blood pressure.

Four hundred and thirty experiments were made upon dogs, monkeys, goats and horses, and the conditions were varied in every way that suggested itself. The anæsthetic was administered in large and in small quantities, with inhalers and without them, even by forcing it into the trachea with bellows. Subjects were held in perpendicular and horizontal positions and in glass and wooden boxes. The conditions were modified by hypodermic injections of morphia, strychnine, cocaine and atropine, alone and in combination; in other cases the heart and other organs had been rendered fatty by a course of phosphorus, and in still other cases the subjects were affected with cardiac disease. The condition of the digestive apparatus was also varied, some of the subjects having been deprived of food for some time, and others having partaken of starchy or fatty food or of meat; the administration of Liebig's extract, coffee and ammonia previous to giving the chloroform also modified the conditions in certain cases.

The commission premised that its objects were five in number, viz.:

I. To test the suitability and safety of chloroform as an anæsthetic. Experiments with ether and the A. C. E. mixture were instituted principally for the sake of comparison with chloroform on certain points, and it is not pretended that they afford a complete exposition of the action of those agents on the system.

II. The effect of pushing the above named anæsthetics (*a*) to a dangerous degree, and more especially until the respiration ceases; (*b*) until death results.

III. The modifications in the effects of these anæsthetics which result from (*a*) asphyxia in varying degrees and produced by various means, (*b*) from the use of drugs such as morphine, atropine, physostigmine, and others.

IV. The reality or otherwise of the alleged liability during ordinary chloroform administration to the occurrence of primary or secondary

syncope or stoppage of the heart, brought about either by shock or through fatty or weak heart, or by hæmorrhage, or by changes in the position of the body.

V. The effect of the anæsthetics above mentioned upon different animals, more especially upon monkeys, as the nearest approach to human beings.

These experiments proved to the satisfaction of the commission that chloroform, when given continuously by any means which insures its free dilution with air, causes a *gradual* fall in the mean blood-pressure, provided the animal's respiration is not impeded in any way, and it continues to breathe quietly without struggling or involuntary holding of the breath. Struggling, independently of any change in the respiratory rhythm, appears generally to raise the blood-pressure. But when struggling is accompanied, as it often is, by acceleration of the respiration and pulse, especially if the respiration is deep and gasping, it leads to a more rapid inhalation of chloroform, and consequently to a more rapid fall of blood-pressure and a greater after-fall.

The theory which has hitherto been accepted, that the danger in chloroform administration consists in the slowing or stoppage of the heart by vagus inhibition, is now shown to be absolutely incorrect. There is no doubt whatever that the controlling influence of the vagus on the heart is a safeguard, and that it is the exhaustion of the nerve which is dangerous.

Complete stoppage of the respiration always means that an overdose has been administered. The overdose may have been so great as to produce a very prolonged after-fall of blood-pressure, and may thus render restoration impossible.

In the course of the experiments of the committee various drugs were administered in order to ascertain if they had any effect in modifying the action of chloroform. The result showed that none of them had any effect in preventing the typical descent of the blood-pressure that occurs when chloroform is inhaled. Atropine, when given in a dose sufficient to paralyze the vagi, of course prevents the action of those nerves in asphyxia, and by increasing the action of the heart it appears to cause a more rapid descent in the blood-pressure when

chloroform is inhaled, as has been already explained. Morphine appeared to render the rise in blood-pressure that occurred when the chloroform was discontinued slower and less complete, and to bring about a more or less permanent condition of anæsthesia.

The other drugs used had no effect upon the action of chloroform, except when their own special action became the leading feature in the case—as, for instance, during vomiting from apomorphine or convulsions produced by nicotine.

In order to test the alleged danger from shock during chloroform administration, the committee performed a very large number of those operations which are reputed to be particularly dangerous in this connection—such as extractions of teeth, evulsion of nails, section of the muscles of the eye, snipping of the skin of the anus, etc. In many cases the operation was performed when the animal was merely stupefied by the chloroform and not fully insensible. In such cases a slight variation in the blood-pressure would sometimes occur, such as one would expect from the irritation of a sensory nerve or from the struggling that ensued, but in no case in any stage of anæsthesia was there anything even suggestive of syncope or failure of the heart's action. In thrusting a needle into the heart, there was often a momentary but well-marked fall of blood-pressure; but even this was absent in all other injuries. If chloroform really had any power to increase the tendency to shock in operations, it is impossible to believe that it would not have been manifested, to some degree at least, in one or other of these numerous experiments. The commission was, however, not content with this negative result, and determined to ascertain the effect of direct irritation of the vagi during continued chloroform administration. The result of such experiments proved that inhibition of the heart's action prevented, rather than assisted, the fatal effects of prolonged chloroform inhalation.

The conclusion of the committee was that chloroform has no power of increasing the tendency to either shock or syncope during operations. If shock or syncope from any cause does occur, it prevents, rather than aggravates, the dangers of chloroform inhalation.

The experiments on dogs that had been dosed with phosphorus for

a few days previously, showed that the fatty and consequently feeble condition of the heart and other organs so produced has no effect in modifying the action of chloroform.

The truth about the fatty heart appears to be that chloroform *per se* in no way endangers such a heart, but on the contrary, by lowering the blood-pressure, lessens the work that the heart has to perform, which is a positive advantage. But the mere inhalation of chloroform is only a part of the process of the administration in practice. A patient with an extremely fatty heart may die from the mere exertion of getting upon the operating-table, just as he may die in mounting the steps in front of his own hall-door, or from fright at the mere idea of having chloroform or of undergoing an operation, or during his involuntary struggles. Such patients must inevitably die occasionally during chloroform administration, and would do so even were attar of roses or any other harmless vapor substituted for chloroform.

The effect of hæmorrhage was tested by opening the femoral artery and allowing a considerable quantity of blood (eight to twelve ounces) to escape. An immediate lowering of the blood-pressure results, and this is very slowly recovered from. Such an accident, however dangerous it may be in itself, in no way affects the action of chloroform, except in so far that a patient who has been nearly bled to death would require less chloroform in his system to put him into a state of anæsthesia. The low condition of his blood-pressure produced by the hæmorrhage would tend to prevent the too rapid intake of chloroform.

Inversion of the body failed to restore an animal that was in the last stage of chloroform poisoning, though it raised the blood-pressure in the carotid artery as long as it was continued. This change in the pressure of blood of the carotid appeared therefore to be due simply to gravity.

In the experiments with ether it was found impossible to produce efficient anæsthesia unless some form of inhaler was used which would thoroughly exclude the air. As soon as the air is rigidly excluded, the blood-pressure commences to fall gradually, exactly in the same way as with chloroform, and with the same succession of phenomena, viz., first anæsthesia, then cessation of respiration, then of the heart move-

ments, and finally death. An exactly similar succession of events can be brought about by making an animal inhale carbonic acid gas alone.

The A. C. E. mixture given gently with plenty of air and the other conditions mentioned before under chloroform produces the typical chloroform trace.

In the cases of accidental deaths that occurred during the experiments, the fatal result was brought about either by neglecting to watch the condition of the respiration during or after the administration of chloroform, especially while the carotid artery was being exposed, or from a reckless administration of chloroform in the endeavor to check or prevent struggles.

PRACTICAL CONCLUSIONS.--The following are the practical conclusions which the commission think may fairly be deduced from the experiments recorded in this report.

I. The recumbent position on the back and absolute freedom of respiration are essential.

II. If during an operation the recumbent position on the back cannot, from any cause, be maintained during chloroform administration, the utmost attention to the respiration is necessary to prevent asphyxia or an overdose. If there is any doubt whatever about the state of respiration the patient should be at once restored to the recumbent position on the back.

III. To insure absolute freedom of respiration, tight clothing of every kind, either on the neck, chest or abdomen, is to be strictly avoided; and no assistants or bystanders should be allowed to exert pressure on any part of the patient's thorax or abdomen, even though the patient be struggling violently. If struggling does occur, it is always possible to hold the patient down by pressure on the shoulders, pelvis or legs, without doing anything which can by any possibility interfere with the free movements of respiration.

IV. An apparatus is not essential, and ought not to be used, as, being made to fit the face, it must tend to produce a certain amount of asphyxia. Moreover, it is apt to take up part of the attention which is required elsewhere. In short, no matter how it is made, it introduces

an element of danger into the administration. A convenient form of inhaler is an open cone or cap with a little absorbent cotton inside at the apex.

V. At the commencement of inhalation care should be taken, by not holding the cap too close over the mouth and nose, to avoid exciting, struggling, or holding the breath. If struggling or holding the breath do occur, great care is necessary to avoid an overdose during the deep inspirations which follow. When quiet breathing is insured as the patient begins to go over, there is no reason why the inhaler should not be applied close to the face; and all that is then necessary is to watch the cornea and to see that the respiration is not interfered with.

VI. In children, crying insures free admission of chloroform into the lungs; but as struggling and holding the breath can hardly be avoided, and one or two whiffs of chloroform may be sufficient to produce complete insensibility, they should always be allowed to inhale a little fresh air during the first deep inspirations which follow. In any struggling persons, but especially in children, it is essential to remove the inhaler after the first or second deep inspiration, as enough chloroform may have been inhaled to produce deep anæsthesia, and this may only appear, or may deepen, after the chloroform is stopped. Struggling is best avoided in adults by making them blow out hard after each inspiration during the inhalation.

VII. The patient is, as a rule, anæsthetized and ready for the operation to be commenced when unconscious winking is no longer produced by touching the surface of the eye with the tip of the finger. The anæsthetic should never under any circumstances be pushed till the respiration stops; but when once the cornea is insensitive, the patient should be kept gently under by occasional inhalations, and not allowed to come out and renew the stage of struggling and resistance.

VIII. As a rule, no operation should be commenced until the patient is fully under the influence of the anæsthetic, so as to avoid all chance of death from surgical shock or fright.

IX. The administrator should be guided as to the effect entirely by the respiration. His only object, while producing anæsthesia, is to see that the respiration is not interfered with.

X. If possible, the patient's chest and abdomen should be exposed during chloroform inhalation, so that the respiratory movements can be seen by the administrator. If anything interferes with the respiration in any way, however slightly, even if this occurs at the very commencement of the administration, if breath is held, or if there is ster-tor, the inhalation should be stopped until the breathing is natural again. This may sometimes create delay and inconvenience with inexperienced administrators, but experience will make any administrator so familiar with the respiratory functions under chloroform that he will in a short time know almost by intuition whether anything is going wrong, and be able to put it right without delay before any danger arises.

XI. If the breathing becomes embarrassed, the lower jaw should be pulled, or pushed from behind the angles, forward, so that the lower teeth protrude in front of the upper. This raises the epiglottis and frees the larynx. At the same time it is well to assist the respiration artificially until the embarrassment passes off.

XII. If by any accident the respiration stops, artificial respiration should be commenced at once, while an assistant lowers the head and draws forward the tongue with catch-forceps, by Howard's method, assisted by compression and relaxation of the thoracic walls. Artificial respiration should be continued until there is no doubt whatever that natural respiration is completely re-established.

XIII. A small dose of morphia may be injected subcutaneously before chloroform inhalation, as it helps to keep the patient in a state of anaesthesia in prolonged operations. There is nothing to show that atropine does any good in connection with the administration of chloroform, and it may do a very great deal of harm.

XIV. Alcohol may be given with advantage before operations under chloroform, provided it does not cause excitement, and merely has the effect of giving a patient confidence and steadying the circulation.

The commission has no doubt whatever that, if the above rules be followed, chloroform may be given in any case requiring an operation with perfect ease and absolute safety so as to do good without the risk of evil.

2. Mr. Wilson remarks that there may be several objections taken to the unreserved application to man of the conclusions of the experiments of the Hyderabad Commission. In continuation he says:—First, there is the difference which may exist in the action of chloroform on the heart of man and of animals. There is the possibility that the habits of life the taking of stimulants and narcotics, especially the habitual use of drugs like tobacco—for the condition of the vagus centre is shown to be of great importance in relation to chloroform narcosis—may have some effect, if not in altering the behavior of the heart muscle or its innervation, at least in modifying that chain of events upon which depends the absorption and distribution of the chloroform by the blood.

Amongst other points of difference between man and the animals experimented on are the relation of the vital capacity to the size of the animal, and the interference with complete filling of its lungs, resulting from holding of the animal. It has often been shown that the suddenly fatal cases are rare in human subjects in which there is any impediment to the free expansion of the chest—*e. g.*, Clover has pointed out that a phthisical patient is less likely to take a fatal dose of chloroform than one with healthy lungs, because his chloroform absorbing capacity is diminished. Again, it has been noted that few patients die suddenly from chloroform when it is inhaled lying on the side; also, few, if any, sudden deaths are reported in case of ovarian tumors. The explanation of these cases is that the interference with full expansion of the lungs by the position or the presence of the tumor prevents the lungs taking in the necessary fatal dose.

On the other hand, the greater number of the suddenly fatal cases occur in people with healthy chests and large vital capacity, *e. g.*, in reducing dislocations of the shoulder, and in minor operations, such as teeth extraction, especially in those in which the patient, being in the natural upright position, can give the respiratory muscles full play, and completely fill the chest.

Thus it is worth considering if the holding of a struggling animal, such as a dog, might not so interfere with its breathing as to prevent the full dose being taken, especially as the animal would not be likely

to be held in its natural position. There is an indication in the report that, in at least some cases, the holding of the animal did actually interfere with its respiration. If it did so in one case it probably did so in many, especially as a dog's thorax is so shaped that to hold its fore legs together in front of it, would prevent the complete expansion of its chest, and so prevent it suddenly taking a fair dose of chloroform vapor.

In animals, too, we have an absence of the desire to inhale freely. In at least one reported case the wish to inhale the chloroform freely contributed largely to the fatal result.

In chloroform accidents in man, of the very sudden variety, considered to be due to cardiac syncope, a certain set of conditions are present which are difficult to obtain in animals.

The subject is generally young or middle aged, with an expansile chest, the chloroform is willingly inhaled, quietly at first, until semi unconsciousness is produced, when the fauces and glottis are insensitive; then, during struggling, with or without holding the breath, the patient, often in an upright or semi-upright position, and having his arms fixed by the assistants, which gives his respiratory muscles good purchase, gets one or two deep inspirations at the greatest advantage, and so obtains the maximum amount of chloroform.

There is the desire to get under the influence of the drug, the voluntary inhalation followed by the still steady conscious anxiety to inhale more, and then the involuntary deep inspiration, in the natural position in which a deep inspiration can be best taken.

All these are conditions difficult to obtain in experiments on animals, and it is only under such conditions that the supposed cardiac paralysis has been produced in man.

The interval between the stoppage of the heart and the respiration is so short that these points, trivial though they seem, may easily be of importance in modifying the result.

It has always been maintained by the advocates of the syncope theory that it is only under certain circumstances, and by a certain definite combination of factors, that chloroform sufficient in quantity to paralyse the heart can be introduced into the blood, and that this particular

combination of circumstances occurs very seldom—about once in every 1,000 or 2,000 administrations.

Thus, as Dr. Snow pointed out years ago, the effect of chloroform on any given case varies with the amount contained in the blood at any given time.

This depends upon the strength of chloroform vapor exhibited to the patient, the ease with which it is inspired through the glottis, and the depth and frequency of the inspirations; the amount actually absorbed depends upon the condition of the blood (its capacity for chloroform may vary), the time it stays in the lungs, the rapidity of the circulation, and other factors.

The idea was that, by a certain combination of these several factors, the maximum quantity of chloroform was absorbed by the blood in the lungs and hurried to the heart, the next organ in the order of the circulation, not merely distending its cavities with chloroform-saturated blood, but also being distributed by the coronary arteries to every part of its substance, and so causing paralysis. This result is also assisted by the condition of distension of the heart and the venous condition of the blood.

That the arrangement of these various factors—respiration, pulse, etc.—has an important bearing in the action of the drug on the heart, is well shown by these experiments of the Commission. These showed that by varying the methods of administration in different experiments it was possible to make the heart cease beating at intervals of from one to twelve minutes after the cessation of the respiration. It is not impossible that by further variations the time might have been reduced until the stoppage was simultaneous with, or even preceded, the cessation of respiration, and the experiments would have been thus made to accord with certain reported fatal cases in man.

The cases in which the heart ceased soonest after the respiration were cases complicated with asphyxia; that is, cases in which semi-asphyxia was produced, presumably followed by deep inspiration; under these circumstances the heart ceased beating one minute after the respiration stopped. Now it is under conditions similar to these in man, that the so-called cardiac syncope occurs, and it

is by working on these lines that attempts to produce it in animals should be made; but it appears that the Commission only made some four of these experiments, hardly a sufficient number upon which to base an important statement.

In ordinary practice, the several conditions giving a fatal result from cardiac syncope are combined about once in every two or three thousand administrations. Because the Commission did not obtain it in some 600 attempts they conclude that it cannot exist. This is scarcely reasonable, especially as the bulk of their work was not upon the lines which promised the nearest result, viz., those of deep inspiration after semi-asphyxia.

The manner or means by which the movement of the heart was tested are of some moment, as explaining the discrepancy between the results of experiment and practice. Most of the cases were tested by a needle introduced into the heart, or by opening the chest. These methods will indicate the merest quiver of the heart muscle, movements that would give no indication of their presence to ordinary observation, and movements that would probably be of no functional use, *i. e.*, in no sense contractions. It has been noticed by observers that the heart of animals killed by chloroform shows fibrillary irritability, after the heart muscle, as a whole, is incapable of contraction—a condition similar to this would indicate movement tested by the above, but such movement would be fallacious.

It would be interesting to know the degree of action exhibited by the heart after cessation of the respiration. Was the power of propelling blood retained? If the action consisted only of muscular tremors it would be of little value, and hardly what is understood by action of the heart.

In the second portion of the report it is shown that the essential action of chloroform on the system is to cause a fall in the mean blood pressure. This fall is proportionate to the amount of chloroform inhaled into the system. [It would have been interesting to have known the relation, if any, the condition of the blood pressure bore to the state of anæsthesia.]

This fall in blood pressure bears some relation to the respi-

ration, but what this relation is is not distinctly stated, and the cause of the fall in pressure is also not clearly assigned, except that it is not due to the direct action of chloroform on the heart, and must be due to paralysis of the vaso-motor centre. This is important when taken in conjunction with the following parts of the report (Sec. 3): “ * * * If the chloroform is pushed further, there comes a point not easy to define when the blood pressure and respiration will no longer be restored spontaneously, although the heart continues to beat after the inhalation has stopped.” And also (Sec. 25): “ * * * It is never in any case certain that artificial respiration will restore the natural respiration and blood pressure, *no matter how soon it is commenced* after the respiration stops.”

This exposes a comparatively new and insidious danger in chloroform administration, and one as difficult to treat as the old cardiac syncope. It is quite conceivable that under certain circumstances the dose necessary irretrievably to damage the vaso-motor center may be inhaled with extreme rapidity, and that while the respiration and pulse are still present, the centre may be almost paralysed before much warning has been given.

From a record of fatal cases in man, it appears possible that this paralysis may, in certain conditions, be effected almost instantaneously and before complete insensibility has been produced.

The lowering of blood pressure in the case of a fatty heart cannot be altogether an advantage in chloroform administration. It must, by the efforts the heart makes to keep up the pressure, increase the work of the heart, and at the same time diminish the blood supply to the heart itself.

It is important to note that in all these experiments there are double and treble reactions, which, though they have a beneficial effect in diminishing the amount of chloroform absorbed, are in themselves elements of danger.

Thus, semi-asphyxia and inhibition of the heart are elements of safety by preventing the “intake” and distribution of chloroform, but the ultimate result of this is to cause rapid breathing and quick pulse, which by the extra “intake” of chloroform and the quick distribution of that already inhaled, is an element of danger.

This change from a slow to a rapid pulse may be attended with very nearly fatal results, as is shown in Sec. 34, where an animal was nearly killed by a short inhalation from the inhibition of the vagus having been stopped, and a more rapid pulse consequently resulting. This fall in pressure is in itself, in feebly nourished subjects, a source of danger, causing syncope from cerebral anæmia.

Apart from any action which chloroform may have on the heart itself, the experiments made supply abundant reason for a careful observance of the pulse during the administration of the drug, and it is surprising that this point has not been referred to in the practical conclusions.

In the report it is shown that the amount of chloroform inhaled (in the intake) depends upon the respiration, but that the effect of this "intake," the way in which it is utilized, lies with the circulation, with the force and rapidity of the pulse or the reverse.

It is shown that, with a slow pulse, concentrated chloroform vapor can be exhibited with impunity, but with a full, bounding pulse dilute chloroform vapor may be dangerous. These variations occur in practice, from the quick full pulse of a patient with a high temperature to the slow pulse of a patient with jaundice.

As attention to the pulse is so easily managed without neglect of the respiration, and a proper knowledge of the state of the circulation has been proven to be most essential to the intelligent administration of an anæsthetic, it is advisable that the pulse should always be observed; it can, at least, do no harm, and, in conjunction with the respiration is a valuable help, quite apart from any information it gives of the general condition of the patient.

The assistant in charge of the anæsthetic must endeavor to be more than a mere dole out of innocuous doses of chloroform; he should keep himself in touch with the whole condition of the patient all through the operation. To endeavor to narrow his work to mere watching of the respiration is mistaken policy.

If the conclusions of the Commission are accepted in full without reserve, chloroform has no power of paralysing the heart; one danger is removed, but it is replaced by one as great in every respect, viz., par.

alysis of the vaso-motor centre. This may set in very suddenly, with hardly any warning; it is as far beyond treatment as cardiac paralysis, and it is as fatal. If the cardiac paralysis from chloroform does not exist, vaso-motor paralysis must have been the cause of the numerous deaths recorded against chloroform; and how sudden and irremediable this is the reports of fatal cases abundantly testify.

When death occurs from vaso-motor paralysis it is clearly imaginable that the vaso-motor centre may be hopelessly damaged or rapidly reaching that stage, while the pulse is still present and the heart attempting to keep up the pressure. So that for some seconds there may be a deceptive condition in which both pulse and respiration are present, yet a fatal termination is imminent. That this death from vaso-motor paralysis does occur in man is shown by the very rapid running pulse mentioned in some cases as preceding the fatal termination.

The extensive experiments of the Commission have left the chloroform question in the following condition: It was not found possible to directly paralyse or effect the heart by chloroform in some 600 administrations. Death from chloroform is due apparently to paralysis of the vaso motor and respiratory centres—probably one or both of these may be affected. When death occurs it is the result of an overdose of the drug.

TRENDELENBURG ON OPERATIONS FOR VESICO-VAGINAL
FISTULA, AND ON THE ELEVATION OF THE PELVIS
DURING OPERATIONS IN THE ABDOMINAL
CAVITY.¹

By the efforts of Nægle, Dieffenbach, Jobert de Lamballe and Simon, this chapter of surgical gynecology seems to be perfectly closed.

New propositions lay only in the modification of instruments, the position of the patient, suture material, preparation for operation and the after treatment; the principle always remains the same, exposing and refreshing the edges of the fistula through the vagina, closure by

¹Volkman's Sammlung *Klin. Vorträge*, No. 355.